

# Antoine Wehenkel

POST-DOCTORAL RESEARCHER · MACHINE LEARNING

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## PERSONAL STATEMENT

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**"We know the past but cannot control it. We control the future but cannot know it."** Claude Shannon

Passionate **Post-doctoral researcher** at Apple on **machine learning** for the health domain, my research goal is to advance **simulation-based inference** algorithms for misspecified models. I am an engineer excited both by the theoretical foundations of Machine Learning and its real-world impact. During my PhD I developed strategies to embed domain knowledge to deep generative models.

## WORK EXPERIENCE

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- Post-doctoral Researcher** 11/2022 - Now  
*Apple Inc. , Health AI Team (Zürich)*  
Extending simulation-based inference for incomplete models. Application to hemodynamics.
- Research Intern** 11/2021 - 09/2022  
*Apple Inc. , Health AI Team (Zürich)*  
Physics Informed Machine Learning. A publication as a first author is under review at TMLR.
- Applied Scientist Intern** Summer 2021  
*Amazon Web Services (remote)*  
Worked within Codeguru AI team. Defined and developed a project applying deep learning (graph neural networks) to automatic program analysis. Secured an offer for a returning internship.

## EDUCATION

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- Ph.D. student in Machine Learning - ULiège, Liège** 10/2018 - 10/2022  
Advisor: Professor Gilles Louppe  
Research interests: generative modeling, deep learning and simulation-based inference.
- Master in Computer Engineering - ULiège, Liège** 09/2016 - 06/2018  
*Summa Cum Laude - 88%*
- Exchange student in the Master in Data Science - EPFL, Lausanne** 09/2017 - 06/2018  
*Average score: 5.8/6 - 97%*
- Bachelor in Engineering - ULiège, Liège** 09/2013 - 06/2016  
*Magna Cum Laude - 81%*

## PERSONAL RESEARCH PROJECTS

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- Automating signal processing with physical simulations** 2022 - Now  
*Antoine Wehenkel - Jörn-Henrik Jacobsen, Jens Behrmann, Ozan Senner, Marco Cuturi*  
Advancing simulation-based inference for incomplete models with optimal transport.
- Deep Learning for inverse problems in Science** 2018 - 2022  
*Antoine Wehenkel - Gilles Louppe*  
Advancing simulation-based inference by exploring new means for implementing more effectively inductive bias into deep generative models.  
**Co-authored 7 papers, 3 at top Machine Learning conferences and 4 at workshops (2 spotlights).**
- Parameter estimation of transmission lines from synchrophasor measurements** 2017 - 2018  
*Antoine Wehenkel - Arpan Mukhopadhyay, Mario Paolone, Jean-Yves Le Boudec*  
Estimation of transmission lines parameters noisy phasors measurements with sparse non-convex optimisation.  
**Graded 6/6 as a master's thesis at EPFL and published in an international journal.**
- An algorithmic approach for harvesting renewable energy with electric vehicles** 2016 - 2017  
*Antoine Wehenkel - Antoine Dubois, Raphael Fonteneau, Damien Ernst*  
Development of optimisation algorithms for the integration of Electric vehicle fleets in the electrical network.  
**This project was done in collaboration with Engie company and led to a scientific publication.**

## SELECTED PUBLICATIONS

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Robust Hybrid Learning With Expert Augmentation  
Wehenkel A, Behrmann J, Hsu H, Sapiro G, Louppe G, Jacobsen JH  
**Transactions on Machine Learning Research, 2023**

Diffusion Priors In Variational Autoencoders  
Wehenkel A, Louppe G  
*Workshop on Invertible Neural Networks, Normalizing Flows, and Explicit Likelihood Models at ICML 2021.*

Graphical Normalizing Flows

Wehenkel A, Louppe G

*International Conference on Artificial Intelligence and Statistics (AISTATS) 2021.*

Neural Empirical Bayes: Source Distribution Estimation and its Applications to Simulation-Based Inference

Vandegar M, Kagan M, Wehenkel A, Louppe G.

*International Conference on Artificial Intelligence and Statistics (AISTATS) 2021.*

Lightning Gravitational Wave Parameter Inference through Neural Amortization

Delaunoy A, Wehenkel A, Hinderer T, Nissanke S, Weniger C, Williamson A, Louppe G.

*Workshop on Machine Learning and the Physical Sciences at NeurIPS 2020.*

You say Normalizing Flows I see Bayesian Networks

Wehenkel A, Louppe G.

*Workshop on Invertible Neural Networks, Normalizing Flows, and Explicit Likelihood Models at ICML 2020 (Spotlight).*

Unconstrained monotonic neural networks

Wehenkel A, Louppe G.

*Neural Information Processing Systems (NeurIPS/NIPS) 2019.*

Parameter Estimation for Three Phase Untransposed Short Transmission Lines from Synchrophasor Measurements

Wehenkel A, Mukhopadhyay A, Le Boudec JY, Paolone M.

*IEEE Transactions on Instrumentation and Measurement. 2020 Jan 23.*

Recurrent machines for likelihood-free inference.

Pesah A, Wehenkel A, Louppe G.

*Workshop on Meta-Learning at NeurIPS/NIPS 2018 (Contributed talk).*

## SKILLS

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- **Theoretical background:** Deep Learning, Machine Learning, Optimisation, and Statistics.
- **Programming:** Python, Git, Bash, PHP, Javascript, Java, Matlab, C++ and C.
- **Libraries:** PyTorch, Scikit-Learn, Numpy, Pandas, D3, Matplotlib.
- **Communication:** Technical writing, Latex, HTML/CSS, data visualization, teaching.
- **Languages:** French (native), English (professional proficiency).

## TALKS

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- *The Symbiosis between Deep Probabilistic and Scientific Models*. Gen U 2022, Copenhagen. 09/2022
- *Normalizing Flows and Bayesian Networks*. CogSys seminar (DTU). Remote. 10/2020
- *Normalizing Flows for Probabilistic Modeling and Inference*. Montefiore (ULiège) journal club, Liège. 04/2020
- *Neural Likelihood-Free Inference*. GRAPPA (UvA) journal club, Amsterdam. 10/2019
- *Unconstrained Monotonic Neural Networks*. Benelearn 2019, Brussels. 11/2019

## REVIEWING

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- *Conferences:* PMAPS2020, NeurIPS (2020-21), ICLR (2021-22-23), AISTATS (2021-22-23), ICML (2021-22-23).
- *Workshops:* ML4PS (at NeurIPS, 2020-21-22), EBM (at ICLR, 2021), INN+ (at ICML, 2021).
- *Journals:* TMLR (since 2022)

## AWARDS

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- Outstanding reviewer award for ICLR2021 - Awarded to the top 10% reviewers.
- FNRS Research Fellowship (2018 - 2022) - Around 100 awards in Belgium each year.
- NeurIPS Travel Award (2019).
- Best Master's thesis awards from AIM and from AILg (2018) - One award for 40 candidates.
- Ranked 1<sup>st</sup> the "Kaggle in class" machine learning course competition (ULiège, 2016 and 2018) - 64 teams.
- Physics award for outstanding student (2013) - One award for more than 150 students.
- Physics award at Belgian Olympiad (2012 and 2013) - Top-5 among hundreds of students in Belgium.

## REFEREES

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- Gilles Louppe (g.louppe@uliege.be) - Ph.D. advisor.
- Jörn-Henrik Jacobsen - Manager at Apple.

### References

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- [2] Arnaud Delaunoy, Joeri Hermans, François Rozet, Antoine Wehenkel, and Gilles Louppe. Towards reliable simulation-based inference with balanced neural ratio estimation. *Neural Information Processing Systems 2022*, 2022.
- [3] Antoine Dubois\*, Antoine Wehenkel\*, Raphael Fonteneau, Frédéric Olivier, and Damien Ernst. An app-based algorithmic approach for harvesting local and renewable energy using electric vehicles. In *Proceedings of the 9th International Conference on Agents and Artificial Intelligence (ICAART 2017)*, 2017.
- [4] Jonathan Dumas, Colin Cointe, Antoine Wehenkel, Antonio Sutera, Xavier Fettweis, and Bertrand Cornélusse. A probabilistic forecast-driven strategy for a risk-aware participation in the capacity firming market. *IEEE Transactions on Sustainable Energy*, 13(2):1234–1243, 2021.
- [5] Jonathan Dumas, Antoine Wehenkel, Damien Lanaspèze, Bertrand Cornélusse, and Antonio Sutera. A deep generative model for probabilistic energy forecasting in power systems: normalizing flows. *Applied Energy*, 305:117871, 2022.
- [6] Joeri Hermans, Arnaud Delaunoy, François Rozet, Antoine Wehenkel, and Gilles Louppe. Averting a crisis in simulation-based inference. *Transactions on Machine Learning Research*, 2021.
- [7] Joeri Hermans, Arnaud Delaunoy, François Rozet, Antoine Wehenkel, Volodimir Begy, and Gilles Louppe. A crisis in simulation-based inference? beware, your posterior approximations can be unfaithful. *Transactions on Machine Learning Research*, 2022.
- [8] Arthur Pesah\*, Antoine Wehenkel\*, and Gilles Louppe. Recurrent machines for likelihood-free inference. In *MetaLearn Workshop @ NeurIPS2018*, 2018.
- [9] Thibaut Théate, Antoine Wehenkel, Adrien Bolland, Gilles Louppe, and Damien Ernst. Distributional reinforcement learning with unconstrained monotonic neural networks. *arXiv preprint arXiv:2106.03228*, 2021.
- [10] Maxime Vandegar, Michael Kagan, Antoine Wehenkel, and Gilles Louppe. Neural empirical bayes: Source distribution estimation and its applications to simulation-based inference. In *International Conference on Artificial Intelligence and Statistics 2021*, 2020.
- [11] Nicolas Vecoven, Damien Ernst, Antoine Wehenkel, and Guillaume Drion. Introducing neuromodulation in deep neural networks to learn adaptive behaviours. *PloS one*, 15(1):e0227922, 2020.
- [12] Antoine Wehenkel. *Inductive Bias In Deep Probabilistic Modelling*. PhD thesis, ULiège-University of Liège, Liège, Belgium, October 2022.
- [13] Antoine Wehenkel and Gilles Louppe. Unconstrained monotonic neural networks. In *Neural Information Processing Systems 2019*, volume 33, 2019.
- [14] Antoine Wehenkel and Gilles Louppe. Graphical normalizing flows. In *International Conference on Artificial Intelligence and Statistics*, volume 2021, pages 37–45. PMLR, 2020.
- [15] Antoine Wehenkel and Gilles Louppe. You say normalizing flows i see bayesian networks. In *INNF+ Workshop @ ICML2020*, 2020.
- [16] Antoine Wehenkel and Gilles Louppe. Diffusion priors in variational autoencoders. In *INNF+ Workshop @ ICML2021*, 2021.
- [17] Antoine Wehenkel, Arpan Mukhopadhyay, Jean-Yves Le Boudec, and Mario Paolone. Parameter estimation of three-phase untransposed short transmission lines from synchrophasor measurements. *IEEE Transactions on Instrumentation and Measurement*, 69(9):6143–6154, 2020.
- [18] Antoine Wehenkel, Jens Behrmann, Hsiang Hsu, Guillermo Sapiro, Gilles Louppe, and Jörn-Henrik Jacobsen. Robust hybrid learning with expert augmentation. *Transactions on Machine Learning*, 2023.